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REPORT  
OF  
EDWARD F. GAY,  
CIVIL ENGINEER,  
ON THE SURVEY FOR THE IMPROVEMENT OF THE CURVES  
ON THE  
PHILADELPHIA AND COLUMBIA RAILROAD.

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## REPORT.

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CANAL COMMISSIONERS' OFFICE,  
Harrisburg, March 21, 1851. }

Hon. JOHN CESSNA,

*Speaker of the House of Representatives.*

SIR:—Since the sale of that portion of the Philadelphia and Columbia Railroad known as the Schuylkill level, and rendered useless by the avoidance of the inclined plane, the Canal Commissioners have caused a survey to be made for the general improvement of the curves on that portion of the line embraced between the two roads, which have been constructed to avoid the Schuylkill and Columbia inclined planes; and herewith submit the report of Edward F. Gay, the engineer entrusted with the surveys.

The board would remark, that while they have confidence in the statements of the engineer; and are fully sensible of the proposed improvements, they do not deem it expedient, at this time, to ask for an appropriation exceeding one hundred thousand dollars, believing that that sum will be sufficient (with the funds which will be available from the sale of the road rendered useless by the avoidance of the plane) to enable them to prosecute so much of the proposed improvements during the present season, and as rapidly as may be deemed consistent with a due regard to economy.

I have the honor to be, very respectfully,

Your obedient servant,

J. A. GAMBLE,  
*President pro tem.*

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*To the Board of Canal Commissioners of Pennsylvania:*

GENTLEMEN:—Pursuant to your instructions, I have made the examinations deemed necessary, with a view to the improvement of the curves on the Columbia and Philadelphia Railway, and have now the honor to report to you the result.

In the preliminary reconnoisance of the route, I was accompanied by Robert Faries, Esq., (William B. Foster, Esq., being otherwise engaged) who concurred with me as to the points at which alterations were desirable, and the mode of the proposed improvements, in accordance with which all subsequent surveys have been guided.

The examinations made, have consumed more time than had been anticipated, in consequence of the inclement season of the year in which they were undertaken, and also from the necessity of running several lines on different parts of the route, with a view to determine the most economical mode of effecting an improvement, so as to retain in use the greatest possible extent of the present road.

The original length of the Columbia and Philadelphia Railway was eighty-two miles, and of this the aggregate length of straight lines was fifty-one miles, and of curvature thirty-one miles. By the construction of the roads to avoid the Columbia and Schuylkill inclined planes, the length of the road has been reduced one mile, and the location changed and permanently improved for the further distance of fourteen miles, thereby reducing the present length of old road to sixty-seven miles, of which about forty-two are straight, and twenty-five curved. The radius of curvature upon this part of the road varies from 630 to 2,000 feet, but a large portion of this ranges from 630 to 1,000 feet.

The general character of the old road, and its location, may be described as follows, viz.: Commencing at the west end of the new road to avoid the Schuylkill inclined plane, the line (owing to the rugged character of the country) is somewhat undulating, and follows, as nearly as practicable, the ridge dividing the waters flowing into the Schuylkill and the Delaware, as far as the intersection with the West Chester railway (14 miles). This division of the road is excessively curved, but will admit of considerable improvement without extraordinary expense. From the West Chester intersection the road is carried with a descending grade along the face of the hill forming the southern boundary of Chester Valley, to the western bank of Valley creek (about 9 miles). This was probably the most expensive portion of the road in its original construction, being formed chiefly of deep excavations and high embankments; the line following all the irregularities of the hill surface, is very much curved, and its improvement will necessarily be expensive. That some idea may be formed of its defective location, an inspection of Map No. 2 will show, that on a single straight line of less than two miles in length, surveyed for the improvement, the present road was crossed *six* times, and at no point was the *New* line more than one hundred and fifty feet distant from the *Old*. This division of the road is commonly known to locomotive engineers, and others familiar with its use, as "Boyer's Grade," and from its continued ascent eastward, and excessive curvature, is esteemed the most difficult portion of the road to overcome with heavy trains; its improvement, therefore, is worthy of consideration; but it cannot be rendered perfect, without a change in the location of more than one-half of its entire length, and this (as I have before stated) at a heavy expense. The location at Valley creek is peculiarly defective, and the bridge itself is in such a condition as will render its renewal imperative in the course of the ensuing two or three years. I have, therefore, contemplated in the estimate a change in the location at this point, and the substitution of an embankment and culvert in lieu of the present bridge—an improvement much needed. From the west side of Valley creek, the road is constructed through Chester Valley as far as Nobleville, where it deflects suddenly to the right, and pursues a northerly course along the head-waters of the Octorara creek to the Gap (distance 21 miles.) This division of the line, with the exception of points at *Caln*, *Coatesville*, *one mile above Midway*, and a *reversed curve at Nobleville and Christiana* (commonly known as "Cape Horn"), may be considered the most favorable portion of the whole road; its location (the points referred to excepted) cannot well be modified or improved, except at a cost which would not be justified by a true regard to economy. From the Gap the road descends into Lancaster Valley, which it pursues to its terminus at Columbia. The division extending from the Gap to Lemmon Place, about  $5\frac{1}{2}$  miles, is very defective in its location; its general direction and character, however, are such that it cannot be essentially improved, except by the construction of a new road for about four miles of the distance, for which provision has been made in the estimate, more with a view to present the cost of works which would render the ultimate improvement of the road perfect, than from the expectation that the construction of such an extent of new road would be expedient at this time; besides, this division will admit of more extensive examinations than has yet been made of it, and it is not improbable that the object sought can be attained at much less expense than estimated from the present surveys. From *Lemmon Place* to the *Horse Shoe Bridge* ( $8\frac{1}{2}$  miles) the location of the road is good, with exception of the curvature near the *Bird in Hand* and *Mill Creek*, which could be almost entirely removed by the construction of about two miles of new road; but as the advantages gained by such a change would scarcely prove equivalent to its cost, I cannot recommend the alteration at this time. Near the *Horse Shoe Bridge*, and between it and the *Conestoga Bridge* (about  $2\frac{1}{2}$  miles), the road is susceptible of material improvement, the cost of which is included in the estimate. Immediately west of the *Conestoga* a short reversed curve occurs, which can be removed at a moderate cost, and, if done, would essentially improve the road and facilitate the entrance of trains upon the bridge. From the *Conestoga* (through *Lancaster*) to the intersection with the *Harrisburg railroad* ( $2\frac{1}{2}$  miles), no improvement can be made consistently with a due regard to economy. From thence to *Rohrerstown* (a further distance of 2

miles) the road is much curved, but can be greatly improved on each side of the "Little Conestoga creek;" this improvement would be expensive, and yet would be justified by its utility; the estimate provides for filling up two out of five spans of the bridge over the Little Conestoga.

From Rohrerstown to the intersection with the road constructed to avoid the Columbia inclined plane (two miles), a change of location has been designed near the latter point, which would be cutting off a large circuit made by the present road from a useful and handsome improvement. The road from the intersection to Columbia has been well located, and requires no alteration. I have already reported to your board, the cost \$65,000 of grading and laying the north track on this portion of the road; this work is now under contract, and will be urged to an early completion. Having thus described the general character of the unimproved portion of the Columbia Railway, I may here state, that the surveys and estimates made, contemplates all the improvements deemed necessary to adapt the road, in its general features, for successful completion with rival improvements.

In its present condition, it cannot be expected to afford accommodation for the trade and *travel* that may reasonably be anticipated for it, on the completion of the Pennsylvania Railroad to the Ohio river, much less, when the great chain of railroads now in the progress of construction from Pittsburg west, through Ohio, Indiana, and Illinois, to the Mississippi, are completed; and admitting new rails to be laid upon the road with its present curvature, how long will they last? probably not more than *six*, certainly not more than *eight* years, before the condition of the road would be as bad as it now is. With this view of the subject, I present the following estimate for a general improvement of the curves on the road; and in doing this, I do not anticipate that means will be forthwith provided for the accomplishment of all the work estimated, but furnish it as a basis upon which improvements may be made, with a view to the ultimate completion of the whole, so as to render the road a favorite medium for communication with the *far west*! The estimate contemplates new *double* tracks complete; whenever alterations are proposed, *round numbers* are assumed for convenience sake.

### ESTIMATE.

LOCALITY.	Length of Proposed Line.	Cost of Grading.
Improved line near White Hall - - -	5,700 feet	\$24,500
" " " Morgan's Corner - - -	6,800 "	16,500
" " " Siterville - - -	4,200 "	10,000
" " " West of Eagle station - - -	3,550 "	28,500
" " " near Old Spring House T - - -	2,000 "	4,500
" " " Reesville - - -	4,270 "	7,500
" " " Paoli - - -	3,200 "	3,000
" " " above Green Tree Tavern - - -	6,800 "	11,000
" " " W. C. Intersection - - -	9,300 "	36,000
" " " near Steamboat station - - -	8,600 "	27,500
" " " at Walkerstown - - -	2,650 "	14,000
" " " near Oakland T - - -	3,640 "	16,500
" " " at Valley Creek - - -	3,000 "	51,000
" " " Caln - - -	4,600 "	4,500
" " " Coatesville - - -	3,600 "	4,500
" " " 1 mile above Midway station - - -	4,840 "	15,000
" " " 'Cape Horn' - - -	4,500 "	30,000
" " " 'Gap' to Lemmon Place - - -	21,000 "	121,200
" " " near Horse Shoe Bridge - - -	1,500 "	1,300
Carried forward - - -	103,750 "	\$427,000

## REPORT OF EDWARD F. GAY.

LOCALITY.		Length of Proposed Line.	Cost of Grading.
Brought forward	- - -	103,750 feet	\$427,000
Improved line between Horse Shoe & Conestoga			
Bridges	- - -	8,500 "	25,500
" " West End Conestoga Bridge	- -	4,100 "	2,000
" " East of Little Conestoga	- -	3,500 "	18,000
" " West " "	- -	4,100 "	9,000
" " near 'Intersection'	- -	6,000 "	16,000
		129,950 "	\$497,500
Double Track, per foot \$3	- - -		389,850
North Tracks at White Hall and Columbia	- - -		75,000
			\$962,350
Add for Damages, contingencies, &c., 10 per cent	- - -		96,235
Total	- - -		\$1,058,585

The extent of improvements provided for in the preceding estimate is 24<sup>5</sup> miles nearly, and would, if constructed, displace over 25 miles of the old tracks, much of the iron of which would answer for repairs, and thereby allow the balance of the old road to be kept in good condition for several years.

With a view to the construction of a portion of the improvements suggested in the above estimate, or in such modified form as would admit of future extensions, I have prepared the following estimate for work, which embraces some of the shortest curves on the line:

## ESTIMATE.

LOCALITY.		Length.	Cost of Grading.
Improved line near White Hall	- - -	4,000 feet.	\$8,500
" " " Morgan's Corner	- - -	3,000 "	13,000
" " " Siterville	- - -	4,200 "	10,000
" " " West of Eagle station	- - -	3,500 "	28,500
" " " near Spring House Tavern	- - -	2,000 "	4,500
" " " Reesville	- - -	4,270 "	7,500
" " " above Green Tree Tavern	- - -	6,800 "	11,000
" " " at Walkertown	- - -	2,650 "	14,000
" " " Valley Creek	- - -	3,000 "	51,000
" " " Caln	- - -	4,600 "	4,500
" " " 1 mile above Midway	- - -	4,840 "	15,000
" " " Cape Horn'	- - -	4,500 "	30,000
" " " near Horse Shoe Bridge	- - -	1,500 "	1,300
" " " West End Conestoga Bridge	- - -	4,100 "	2,000
" " " Little Conestoga Bridge	- - -	4,000 "	9,000
		57,060 "	\$209,800
Double Track, per foot \$3	- - -		171,180
North Tracks at Columbia and White Hall	- - -		75,000
			\$455,980
Damages, contingencies, &c., 10 per cent.	- - -		45,518
Total	- - -		\$501,578

The work included in the foregoing estimate will of itself constitute a valuable improvement to the road, if made; it would displace nearly 11 miles of old road, the iron from which could be used for repairs. It is to be hoped, therefore, as the amount of actual appropriation necessary will be but about \$250,000, in addition to the fund already at the disposal of your Board, that no difficulty may be experienced in procuring the necessary legislative action to ensure the sum required.

The following estimate has been prepared with a view to the improvement of the road as far as practicable, with the means available from the sale of the Schuylkill Level, &c.:

### ESTIMATE.

LOCALITY.	Length.	Cost of Grading.
Improved line near Morgan's Corner - - - - -	6,800 feet.	\$16,500
" " " Siterville - - - - -	4,200 "	10,000
" " " Old Spring House Tavern - - - - -	2,000 "	4,500
" " " Reesville - - - - -	4,300 "	7,500
" " at 'Cape Horn' - - - - -	4,500 "	30,000
	<hr/> 21,800 "	<hr/> \$68,500
Double Tracks, at \$3 - - - - -		65,400
North Track at Columbia - - - - -		65,000
North and South Tracks below White Hall - - - - -		24,000
	<hr/>	<hr/> \$222,900
Damages and contingencies, 10 per cent. - - - - -		22,290
	<hr/>	<hr/> \$245,190
<b>Total</b> - - - - -		

By reference to the accompanying maps, all the improvements contemplated in the preceding estimates will readily be seen, as being represented by *red dotted* lines.

By the changes proposed, the length of the whole road will be reduced about one and a-half mile. The grades will, in some instances, be slightly increased, but not so much as sensibly to diminish the useful effect gained by substituting straight lines for curves, and should all the improvements herein recommended be adopted and completed, I am clearly of opinion, that the annual saving in wear and tear of machinery on the road, to say nothing of the road itself, would exceed twenty per cent., an important item in the motive power department of the road, and an equally important one to transporters of freight or passengers. It has been suggested, that the improvement of the road could best be attained by re-laying *one* track with new iron; this would undoubtably be best, admitting the location of the road to be free from serious imperfections; but to lay new iron upon such parts of the road as are formed by a continued series of curves, appears to me to be both unwise and impolitic, as, by retaining in use a form of road conducive to excessive wear and tear, cannot fail to render it always a source of great expense, and highly objectionable as a medium for transportation both of persons and property. Entertaining such views, therefore, I beg leave earnestly to urge upon your board the propriety of applying all the means that may be available for this road, to the permanent improvements herein suggested, feeling assured that, if in this you are sustained by prompt and generous legislative aid, the Columbia and Philadelphia Railway, can soon be placed in condition to compete successfully in the great strife soon to take place among rival railroads.

Very respectfully submitted,

EDWARD F. GAY, *Engineer.*

